NOTE ON THE HABITS OF *OSMIA GEORGICA* CRESSON[1] AS ASCERTAINED BY THE GLASS-TUBE METHOD

By Carl G. Hartman, assisted by
Paul and Philip Hartman and Carl Rettenmeyer

In the summer of 1940, at "Holiday Heights" in Bethlehem, Conn., while amateurishly taking snap-shots and motion pictures of solitary bees and wasps, we were favored by visits of any number of individuals of *Osmia georgica* females to our glass-tube domiciles. We were able to observe, through the transparent walls of the tubes, the domestic activities of the bee, including the manner of making "bee-bread" and laying the egg upon the accumulated mass. Fabre used this method with *Osmia tridentata*, not so much for habit studies as to determine the sequence of the sexes of the offspring and the "control" of sex by the female according, as Fabre believed, to the conditions imposed by the experimenter — a line of investigation as significant today as it was forty years ago, when the senior author's preceptor, Dr. William Morton Wheeler, first discussed the subject with his students.

As the writers find, in any of several books (1) on the life of the bee, no statement concerning the manner in which bee-bread is compounded, it seemed desirable to prepare a note on what we saw in our glass tubes of certain essential activities of this delightful little insect.

Our *Osmia* worked in a glass tube having a bore of 4 to 5 mm. — large enough to work in but too narrow for her to turn around. When the latter was necessary, as when changing from honey deposition to pollen brushing, after invariably trying at least once to turn around within the tube, she would back out, turn around at the entrance on our adhesive-type platform provided for a landing place, and return tail first. This habit is mentioned by Fabre (2) also. It is probable that all tube-filling bees and wasps react to narrow passages in an identical manner,

[1] Thanks are due Dr. H. H. Ross, Illinois State Natural History Survey, Urbana, for kindly identifying the specimen.

for we have seen it so often in various species that we take for granted that insects generally are masters of the situation mentioned.

Storage of bee-bread proceeds with our *Osmia* in a different manner from that described by Fabre for *O. tridentata*. This French species places the honey in the center and surrounds it with pollen; the outer mass remaining dry. The egg is laid in the central portion, where the newly hatched grub first comes upon it: "for the new-born, dainty bread and honey; for the adolescent, just plain dry bread." (2)

Not so with the Connecticut *Osmia* observed by us — her offspring receive bread and honey, thoroughly mixed, throughout their larval life. This follows of necessity from the manner in which the bee applies the honey and the pollen on each and every trip. Entering the nest head-first on her return from a foraging expedition, she proceeds at once to the bottom of the cell and smears the regurgitated honey initially over the partition just built, then on the growing mass of provender. The deposition of honey requires much longer than one might expect, a fact discovered in viewing scenes in the motion picture.

The honey thus applied provides a sticky surface suitable for holding the dry pollen brushed over it. After turning around in the manner indicated above, the bee backs down the nest as far as possible and scrapes the pollen from her abdomen with her hind legs, a procedure which engages her about as long as the deposition of the honey. Thirty-five to forty trips were counted several times (by C. R.) for the storage of a single cell.

To lay the egg the bee backs in and touches the bee-bread with her abdomen. After numerous abdominal contractions (on which the breathing movements are superposed, as in the case of *Trypoxylon* and *Odynerus*) the relatively large egg is expelled and stuck by one end to the mass of provender.

Leaf pulp is used for building the partitions and closing the nest. As witnessed on several occasions by the younger members of the party, the bee scrapes the material from the upper surface of leaves, rolling it (doubtless mixed with glandular secretion as cement) into the usual rounded pellet for ease of carrying. Front legs and mandibles constitute the tools after the manner of most hymenopteran artisans; but one gets the impression from the way the bee doubles up around the struc-

ture being built, so long as this is possible, that the abdomen at times also functions in the building, as seen by Fabre in the case of *O. tridentata*, a species which, however, uses mud as its building material.

After the partition is completed, the next step is not immediate resumption of foraging among the flower blossoms, but instead laying off a "building line" for the next partition. This preliminary structure, made of mud by *O. tridentata*, of leaf pulp by our *Osmia*, is a ring of the material applied to the glass tube at the appropriate place, to "mark off," so it looks to the observer, the limits of the next cell.

When first seen at this work the bee was working with her head outward, tail inward. She had gathered new leaf pulp for the purpose and backed into the cell. With her tail touching the last partition she was laying off the site of the next one, not yet needed; and the whole process looked as though she were measuring with her body, thigmotactically, as it were. Indeed, our notes contain the words "Is she measuring?", an expression Fabre had used fifty years before in connection with *tridentata*.

Parenthetically be it remarked that nowhere in the field of animal behavior is more anthropomorphism exhibited than among students of the solitary hymenoptera. Fabre himself has a unique way of setting up straw effigies of teleology and anthropomorphism, only to knock them down. With the latter he is quite successful but, being an advocate of the notion of perfection and invariability of instinct, his preconceived teleological explanations sometimes find justification in "appropriate" experiments.

All would be well with the idea of *Osmia's* "measuring" were it not for the fact that she seldom works with the body oriented as indicated! More usually she works with tail outward, not inward; nor does she leave the next to secure the few loads of material needed for the ring. Instead, she filches the "mortar" from the finished partition, backing up with each mandible-ful to apply it to the circular line in question. Under such circumstances there is no suggestion of "measuring" even to anthropomorphic eyes.

The last cell is usually empty; that is, there are usually two closing partitions, the outside one, which is flush with the end of the tube, being generally the thickest of all.

References

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[2]J. H. Fabre, Bramble-bees and Others. A. T. de Mattos, trans. New York, 1922.